

# Armenia: Results of Pilot Project on Fuel Substitution

**Contract No. LAG-I-00-98-00005-00**

**Task Order No. 13**

May 3, 2001

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Version: 1.0

## **EXECUTIVE SUMMARY**

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This pilot project in Armenia was completed to evaluate the benefits of fuel substitution (changing from electric to natural gas), primarily for heating purposes. The project provided information on the energy savings for project participants who replaced electric heating with natural gas heating. This pilot project is part of the requirements of Task Order 13 under contract LAG-I-00-98-00005-00, Subtask C.

The pilot project tested the installation and use of natural gas fired space heaters in residences, both individual homes and apartments. In most cases, the gas heaters replaced the existing electric resistance heating. These gas fired units are available in various sizes and types, including vented and unvented. The unvented equipment is virtually 100% energy efficient.

Although the contract for the project ended before an entire winter season of use could be analyzed, there are several important findings and recommendations from the project.

### **MAJOR FINDINGS**

The major findings include:

- The preliminary results indicate an overall cost savings for energy of nearly 34% per month during the heating season for participants.
- Preliminary results show a sizable decrease in the average amount of electricity consumption, based on data obtained for the months of February and March. For those apartment dwellers on Atoyán Street at the Nor Aresh site, the average monthly use decreased by 52 kWh during the two month period. This represents savings of 24.6% or 1,300 AMD (\$2.40) per month per participant.
- Consumers appear to be anxious and willing to use natural gas for space heating and cooking, thus replacing the current use of electricity, propane, wood and kerosene.
- The natural gas distribution company does not have a marketing plan to expand the system for residential consumers, nor do they have policies and procedures in place to sign up new consumers.
- The policies and procedures for new natural gas line expansions, inspections and customer connections are not well documented nor known by the consumers.
- There is little, or no, modern equipment for use by the gas companies in constructing and installing new natural gas distribution lines, or the service connection lines to new consumers.
- All new natural gas distribution lines are installed above ground, usually about three meters high, supported by steel poles and attached to buildings or other convenient structures. This creates a potential high risk of hazard from traffic and other elements that may damage the lines and create safety problems due to escaping gas.
- There are few distributors of natural gas space heaters in Armenia.

## RECOMMENDATIONS

Recommendations for the Government of Armenia and the natural gas companies include:

- The Ministry of Energy should develop and implement an overall policy for providing natural gas resources for use by residential and commercial consumers in order to alleviate the need for electric space heating and cooking.
- An overall plan for marketing and expansion of the natural gas system needs to be developed and implemented by the gas distribution companies.
- Training of marketing and customer service personnel for implementing new marketing programs needs to be completed.
- Work on the standardization of installations, inspections, and connections need to be developed and implemented.
- New policies for customer connections need to be developed by the gas companies, approved by the Energy Regulatory Commission and implemented.
- A network of suppliers and distributors of natural gas space heating equipment needs to be developed and marketed to provide the needs of the consumers.
- The natural gas companies need investments in modern equipment to construct and maintain new distribution lines and for customer installations and metering.
- Construction standards need to be developed and implemented for putting the distribution lines underground, thereby alleviating the inherent safety hazards of the current overhead lines.

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## ***1. INTRODUCTION***

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This report is the final report of the pilot project in Armenia to evaluate the benefits of fuel substitution, primarily for heating purposes. The project provides information on the energy savings for project participants who replace electric heating with natural gas heating.

This pilot project is part of the requirements of Task Order 13 under contract LAG-I-00-98-00005-00, Subtask C.

## **2. BACKGROUND AND HISTORY**

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Prior to 1991, natural gas was the principal fuel used by Armenia's residential and industrial sectors. The gas distribution and transmission systems were considered to be well integrated among all the former Soviet republics and consisted of 1,918 km of transmission lines and 14,400 km of distribution lines. Gas supply constituted 84% of the total residential energy use, including 61.5% natural gas and 21.8% liquefied gas. Natural gas was used for cooking, hot water and space heating. Some residential heating was provided by central district heating plants, which supplied hot water from regional boiler stations to the apartment buildings. Electricity was consumed for lighting and household electric appliances.

In 1991, an economic crisis in Armenia followed by a grave energy crisis, caused an interruption of the natural gas supply to all residential and commercial customers. As a result, natural gas use declined from 5.7 BCM (billion cubic meters) in 1988 to 1.4 BCM in 1998. During this time period, only the large electric generation plants and a few large industrial manufacturers were receiving gas. District heating stations did not operate due to the shortage of natural gas. The supply of backup fuels, such as kerosene and heavy oil, was also disrupted due to the collapse of the centralized socialist market system and the economic blockade. A few small distributors imported these fuels but the deliveries were unreliable. Compounding these problems, the Armenian Nuclear Power Plant (ANPP) which provided 40% of the total electric generation in the Republic, was shut down. Between 1991 and 1995, the electricity supply was not stable and the residential sector received service for only a few hours per day. This situation led to the loss of the standard energy sources used by Armenia:

- Gas supply to the residential sector and most of the commercial customers was disrupted;
- Production of electric power were not sufficient to meet demand; and
- Centralized heating supply was interrupted due to insufficient fuel imports.

Due to these hardships, residential customers turned to wood, diesel, kerosene, liquefied gas and other fuel sources in order to heat their apartments and homes. As a result, there have been serious environmental damages, including clear cutting of forests and increased air emissions. Gas distribution networks and residential gas appliances have deteriorated due to non-use.

During the last few years, both the electric and natural gas sectors have made many significant changes, including organizational and structural improvements and progress towards commercialization and privatization. Three thermal plants, two cascade hydro stations and the ANPP are currently providing electric power generation. During the past five years, electricity supplies have been stable and electricity has become the dominant fuel source for households.

Conversely, the natural gas supply systems have not adequately been restored. After being idle for several years, the gas distribution network needs serious rehabilitation and consequently major new investments. Currently, less than 80,000 natural gas customers are being served, compared to 450,000 customers prior to 1991. The distribution companies are slowly beginning to rehabilitate and expand the distribution network.

## 2. Background and History

Likewise, the district heating system is not providing service to many customers. At this time, only 15% of customers who were previous district heating customers previously are receiving service. This sector is facing serious problems due to the inefficiency of these old systems and the lack of metering and billing for individual customers. Several efforts are underway to investigate possible district heating schemes, but no new needed investments are on the horizon.

The current tariffs for energy in Armenia are: 25 Armenian Drams (\$0.045) (AMD)/kWh (electric) and 51 AMD/m<sup>3</sup> (\$0.1/m<sup>3</sup>) (natural gas). Propane is 300-350 AMD/Kg (\$0.54-0.64/Kg).

### **3. PURPOSE OF THE PROJECT**

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PA Government Services, Inc. (PA) proposed to test the use of individual natural gas fired space heaters in residences, both individual homes and apartments. In most cases, the gas heaters replaced the existing electric resistance heating.

The primary purpose of the fuel substitution pilot project was to evaluate the energy savings that residential consumers could expect by switching from electric energy to natural gas for space heating. There were other secondary purposes for the project, including:

- Evaluating consumer acceptance of new natural gas service, and the ability to pay the required deposit for new service;
- Evaluating the gas distribution company's policies and procedures for connecting new customers;
- Evaluating the construction and service connection methods of the gas distribution company;
- Evaluating the technical and legal problems in expanding the natural gas system.

Preliminary estimates showed that the annual gas consumption for heating using individual household gas heaters would be 1000-1500 CM at a cost of \$98-\$147 annually. For similar heat output using electric resistance heating, the annual costs would be \$517-\$779. The advantages of using personal gas heaters for residential customers include:

- Each customer can control his own gas use and comfort level;
- Natural gas is more affordable for the average customer due to the equipment's efficient fuel consumption and the lower price for natural gas.

The potential benefits to Armenia in an overall energy strategy are great. In terms of the system benefits of substituting natural gas space heating for electrical resistance heating, the winter (and system) peak for electricity can be reduced, thus helping to improve the electric system load factor and reducing/deferring the need for new capacity. Additionally, the natural gas supply system can be expanded, an important step to increasing the utilization of the under-utilized natural gas system (only about 20% of the existing capacity is being used).

Environmental benefits will also result with the fuel substitution on a wide scale. For this project, the environmental impacts were assessed as part of the environmental assessment required under USAID regulations. The combustion of natural gas is considered to be less environmentally damaging than the burning of fossil fuels (coal, oil, gas) and biomass (wood). There will be less overall emissions to the environment if natural gas is used directly in an end-use application. The tradeoff with end-use gas consumption (especially in unvented applications) is that the gas emissions are more proximate to humans and can have negative health consequences.

#### 4. PILOT PROGRAM DESCRIPTION

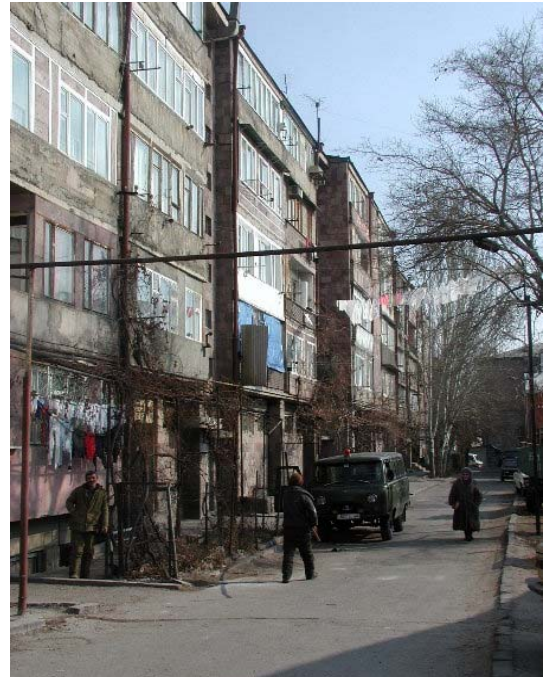
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The following section is a description of the pilot program, describing the equipment, the customer contacts, customer surveys, problems encountered, results, lessons learned and recommendations.

##### PROJECT SITES

In order to estimate the potential impacts for the Republic of Armenia, two separate sites were selected with individual homes and apartments. In selecting the sites, it was necessary that the natural gas supply (distribution lines) be in close proximity and that the electric distribution company have historical billing data available in order to compare energy use before and after the installation of the heaters. The gas company indicated that the sites had to be very near to existing natural gas distribution lines, thus the number of available potential sites was severely restricted due to the small amount of gas lines in service. Several sites were investigated, in cooperation with both the gas company and the electric distribution company. Representatives from the YerevanGas and PA visited and inspected each of the potential sites. It was important to select sites that were representative of the entire customer base in order to apply the results of the study to the population.

The pictures presented below show the sites for the pilot project; the Atoyan street apartment building is on the left and the Papazian apartment is on the right.



#### 4. Pilot Program Description



The picture below is of an individual home on Nor Aresh street. The new gas meter is between the door and the window.



After the sites were selected, representatives of YerevanGas and PA personally contacted each of the participating customers. The purpose of the visits were fourfold: to explain the pilot project; to gain agreement to participate; to conduct a short survey about the household; and, to obtain a contract for the natural gas service by YerevanGas Company. A brochure, shown in Attachment A, explaining the program and the benefits was provided to each participant. After learning of the project during these visits, almost all potential participants agreed to be part of the pilot. Additional requests from neighboring apartment buildings were received as well but were not included. Also, during these visits, it was discovered that several apartments were vacant, although the electric distribution company records indicated that the electric accounts were still active. Neighbors told the PA representative that the owners of those apartments were not living inside of the country at the time.

Prior to the installation of the meter and the connection by YerevanGas Company, each participant was required to sign a contract for service and to pay 40,000 drams as a deposit fee. This deposit fee is the approved amount by the Armenia Energy Regulatory Commission for all new natural gas customers. It should be noted that, although this amount is considered to be a large amount of cash by local standards, almost all of the participants did not express any concern with the payment and were able to pay without asking for a reduction in the amount.

The two sites selected for the pilot project included two apartment buildings on Papazian Street, which contain 87 project apartments and the Nor Aresh/Atoyan neighborhood, which contain 33 single-family homes and 27 project apartments.

#### **EQUIPMENT**

Following USAID procurement guidelines, PA procured four different types of gas-fired space heaters from a U.S. manufacturer. The heaters were purchased from Empire and transported

#### 4. Pilot Program Description

to Armenia via ship and truck. The installation and operating manuals were translated into Armenian for use by the installers, inspectors and participants.



This picture shows a new heater recently installed in an apartment at Atoyan Street.

For those customers living in apartments, three different capacity heaters (10,000 Btu, 20,000 Btu and 30,000 Btu energy inputs) were installed, consistent with the apartment size. For single-family houses, 35,000 Btu vented heaters were installed. These natural gas units are available in various sizes and types, including vented and unvented. The unvented equipment provides virtually 100% energy efficiency. Due to combustible pollutants released during the combustion process, each unvented unit contains an oxygen-depletion sensor that shuts the unit off automatically if inadequate fresh air is available. The individual heaters for each project participant were given to them with an agreement that they would not remove the equipment for at least two years.

PA and ArmRusGasProm, together with YerevanGas, jointly implemented the project. The gas companies assumed responsibility for providing all network rehabilitation and the customer meter connection including the meter itself. They contracted with a private contractor to perform this work, although it was not clear why they were not able to do the work themselves. PA procured the heating equipment, some ancillary equipment and contracted for the inside piping. A local contractor was employed for this work. Each participant decided on the location for the heater and many also had the local contractor extend the gas line to the kitchen for cooking purposes. Prior to the installation, each participant was provided an instruction manual on the operation of the heater, as well as personal operating instructions at the time of the installation and testing.



The picture on the left shows gas lines being installed at the apartment entryway on Atoyan Street. The picture on the right shows gas rehabilitation contractors inside an apartment hallway on Papazyan Street.

The program involved 114 apartments and 33 private homes in the pilot project. The local gas distribution office conducted a thorough examination of each site and supplied the necessary customer information.

The total cost for the heaters and installations was \$411 per participant. Shipping and handling of the heaters amounted to 20% of this cost. Table 1 provides the costs of the project.

**TABLE 1**  
**ARMENIA NATURAL GAS USAGE PILOT PROJECT COSTS**

Qty	Item	Expended Cost
150	Gas Heaters	\$30,769
1 Set	Pipe Locator	\$845
3	Gas Leak Detectors	\$1,724
	Shipping Costs	\$12,668
150	Participant Installation Allowance	\$15,000
114	Apartment Ventilation Work Fee	\$645
<b>Total</b>		<b>\$61,651</b>

## CUSTOMER SURVEY RESULTS

There were two surveys of the participants taken during the project, one at the time they were signed up for the pilot and the second at the conclusion of the heating season. Prior to the installation of the heaters, each participating customer was surveyed to gather baseline

#### 4. Pilot Program Description

information. A copy of the survey form is provided in Attachment B. The results of the survey are shown in Attachment C. The residences at the two sites are deemed to be typical of the apartments and individual homes in Armenia. The average number of people living in the apartments is 3.6 while the average number in the individual homes is 4.8. The heating fuels used by the participants were, on average stated to be: electricity (56%); wood (30.9%) and, kerosene (0.7%). However, for cooking, the fuels used were: electricity (30.1%); propane (71.3%); kerosene (.7%); and wood (.7%).

Therefore, the installation of natural gas for space heating, in addition to replacing the space heating fuels previously used, also provided the participants with the opportunity to replace the fuels previously used for cooking.



This picture shows an apartment with a wood stove and newly installed gas heater. The wood stove will be removed, thus providing more space in the room for the occupants.

The post installation survey was conducted to ask the participants whether they were pleased with the new natural gas service and what problems they might have encountered. Almost 100% of the participants were very happy with the new service; only one indicated that he was not pleased. This person indicated that the heater was not in the correct location (even though he had made the decision where to put the heater).



The small girl in this photo is showing the new gas heater, with the wood stove in the foreground.

### **PROBLEMS ENCOUNTERED**

Several problems arose during project implementation. The problems resulted in delays, and limited, somewhat the information on winter season consumption for analysis of the results of the project. Among the problems encountered were the following:

- The initiation of the construction and installation phase of the pilot was delayed due to an imposition of a moratorium on gas line rehabilitation to multi-floor buildings by the Government of Armenia. The moratorium was put into effect while the government reviewed the adequacy of their standards and norms for such work. The moratorium was lifted in mid-November at which time the government issued modifications to the standards.
- Additional delay was caused due to the need for clarification of the government modifications of the standards and norms for the natural gas pipelines, particularly the interior piping, and the metering installation requirements.
- The Fire Department, whose responsibility it was to certify the adequacy of all work performed, undertook their responsibilities slowly due to illness in at least one instance. Also, there was some delay as they decided on the apartments that could be safely gasified without adding ventilation equipment.
- Confusion in the counterparts' management responsibilities resulted in the transfer of a portion of the counterpart management from YerevanGas to ArmRusGasProm. Prior discussions with YerevanGas by PA (in late 1998) had implied that they had a program in place to expand the gas distribution network. The General Director and Chief Engineer had said that they were adding numerous customers each month due to an aggressive campaign. This proved to be incorrect as was learned by PA after the project began.
- The imposition of additional fees to project participants by the Fire Department in the amounts of 1,500 and 3,000 AMD for certification and ventilation work respectively caused minor disruption.

## 5. RESULTS

Although the available data does not contain a complete winter, the project did provide valuable information that should be used in developing a plan for the future. Based upon information gathered from the apartment participants at the Nor Aresh site and information obtained from YerevanGas and Yerevan (electric) Distribution Company, energy savings were significant. Table 2 shows a breakdown of the average total household energy costs for participants for the month of February. Based on the assumptions, this represents an energy savings of nearly 34% per customer, a significant decrease.

**TABLE 2**  
**COMPARATIVE ENERGY COSTS OF PARTICIPANTS**  
**ARMENIA NATURAL GAS USAGE PILOT PROJECT**

<b>Fuel Type</b>	<b>February 2000</b>	<b>February 2001</b>	<b>Difference</b>
Electricity <sup>1</sup>	\$10.15	\$6.84	(\$3.31)
Propane <sup>2</sup>	\$8.98	\$0.00	(\$8.98)
Kerosene <sup>2</sup>	\$0.81	\$0.00	(\$0.81)
Wood <sup>2</sup>	\$2.23	\$0.00	(\$2.23)
Natural Gas <sup>1</sup>	\$0.00	\$7.81	\$7.81
<b>Total</b>	<b>\$22.17</b>	<b>\$14.65</b>	<b>(\$7.52)</b>

<sup>1</sup> - Based on actual data

<sup>2</sup> - Based on data obtained from Participant Survey

The project results demonstrate the following:

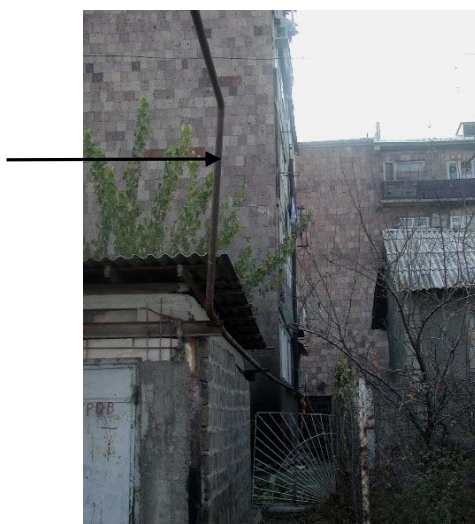
- Preliminary results show a sizable decrease in the average amount of electricity consumption, based on two months (February – March) of data. For those apartment dwellers on Atoyán Street at the Nor Aresh site, the average monthly use decreased by 52 kWh during the two month period. This represents savings of 24.6% or 1,300 AMD per month per participant.
- The participants experienced an increase in their total electric and natural gas billing compared to the year 2000. Preliminary subjective analyses reveals that this is likely due to the use of natural gas for cooking, thus replacing propane as the fuel previously used by 70% of the participants. There was no information available to compare the previous year's costs of propane for each participant. However, the current cost of propane is 300-350 drams/kilogram. Information from propane users that were questioned indicated that they purchase an average of 20 kilograms per month, thus the total costs are approximately 6,000-7,000 drams per month, or \$11.11 to \$12.96 per month (at 540 drams/dollar).
- Consumers appear to be anxious and willing to use natural gas for space heating and cooking, thus replacing the electricity, wood, propane and kerosene currently used. Nearly all of the prospective project participants did not hesitate to sign up with the gas distribution company and pay the required deposit of 40,000 drams.

- The natural gas distribution company does not have a marketing plan to expand the system for residential consumers, nor do they have trained customer service representatives for meeting with potential new consumers. It also appeared that the gas distribution company, as well as ArmRusGasProm, did not care whether they signed up new customers, though the managers said that they were in fact interested.



The photo shows the gas pipelines and the newly installed gas meters in an apartment hallway.

- The policies and procedures for new natural gas line expansions, inspections and customer connections are not well documented nor known by the consumers, nor did they appear to be well-known by the gas company representatives.



This photo shows the gas pipeline attached to the side of the Atoyan apartment building, typical at all natural gas service pipe installations in Yerevan.

- There are few distributors of natural gas space heaters in Armenia. Obtaining replacement parts is very difficult.

## 6. LESSONS LEARNED

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The lessons learned to date from this pilot project are the following:

- The gas distribution company does not have a marketing plan to expand the natural gas service and sign up new customers.
- The gas distribution company does not have standardized installation practices, nor do they appear to have construction crews for installing new gas lines (as evidenced by the fact that they hired a private contractor for this project).
- The process and coordination for inspections, including the correct list of agencies involved, is not well-known, nor documented.
- Consumers are anxious for the natural gas service, even with the required deposit of 40,000 drams to get the meter installed, most were anxious and willing to sign up.
- The gas distribution company did not appear to have policies in place that allowed the field crews to obtain meters when needed. The construction crews had to wait for meters from higher-level officials within the company to release the meters from the warehouse.
- There are no current approved procedures or standards for natural gas to be installed in buildings greater than five floors, due to safety requirements.



This photo shows meter boxes in an apartment hallway. In some cases, the meter boxes were empty for days, waiting for the meters to be released by the distribution company.

- There appears to be a large demand for natural gas heaters similar to those used in the pilot project, but there are few current distributors of these types of heaters in Armenia.
- Nearly all of the participants used the new natural gas service for cooking as well as space heating, thus displacing the propane and other fuels that had previously been used.



As shown in the photo, many customers are using wood vent through the windows. The gas distribution line is attached to the house just under the roof.

- There is little modern equipment for the construction and installation of the natural gas distribution lines and connections to customer premises.



This picture shows some of the antiquated equipment used to install the service lines inside of the buildings.

- All new natural gas distribution lines are installed above ground, usually about three meters above ground, supported by a variety of support poles and attachments to buildings. This creates a potential high risk of hazards from traffic and other elements that may damage the lines and create safety problems from the escaping gas.

## 6. Lessons Learned

The following pictures show examples of typical natural gas distribution lines and service lines. Nearly all of the distribution lines are overhead, supported by steel poles or attached to buildings and other structures. The new service lines observed during the project were installed with inconsistent pipe sizes, and in some cases, old and used connectors and valves.



- Most participants would like to use natural gas for water heating, but the necessary venting in the apartment buildings is not in place.

## **7. RECOMMENDATIONS**

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Based on the results of this pilot, a number of recommendations are offered:

- The Ministry of Energy should develop and implement an overall policy for providing the natural gas resources for use by residential and commercial customers in order to alleviate the need for electric space heating.
- The gas distribution company should develop and implement a marketing plan for the expansion of the system. Training in marketing and customer service is needed for gas company personnel.
- Standardized policies and procedures need to be developed by the distribution company and approved by the Energy Regulatory Commission for extension of services to new customers.
- Standardized inspection policies and procedures need to be developed and publicized.
- If natural gas is to be made available to most residential consumers, then construction standards must be developed for the installation of the gas lines and appurtenant equipment into high-rise apartment buildings
- The natural gas distribution company needs to invest in modern equipment for the construction and installation of new natural gas distribution lines and customer connections.
- A network of distributors of natural gas space heating equipment should be developed and marketed to provide the supply of heaters for the consumers.



**PA** Consulting  
Group

## FUEL SUBSTITUTION

### PILOT PROJECT



**“ARMRUSGAZPROM” CJSC**  
**“YEREVANGAS” GGB**  
Yerevan, Republic of Armenia  
October 6, 2000

The “YEREVANGAS” GGB in cooperation with the Energy Regulatory Commission is conducting a Fuel Substitution Pilot Project. The pilot project is sponsored by the United States Agency for International Development (USAID) and co-implemented by PA Consulting Group (formerly Hagler Bailly).

#### *Purpose and concept of the Pilot Project*

The purpose of the Fuel Substitution Pilot Project is to determine the benefits of natural gas usage as a primary heating fuel in Armenia, and to develop fuel substitution mechanisms for existing fuel sources such as electricity, kerosene and wood. This project also has an objective of evaluating the residential electricity load shift resulting from heating fuel substitution.

Based on the historical fuel consumption practices in Armenia as well as economic and efficiency indicators, natural gas is believed to be the most beneficial fuel for residential and commercial heating purposes. For example, it is estimated that if you heat your residence using 1000 kWh of electricity per month, you will pay 25,000 dram per month according to the current tariff for electricity. To get the same amount of thermal energy and heat your residence using natural gas heaters you will pay only 7,000 to 8,000

drams according to the current tariff for gas which is 51dram/m<sup>3</sup>.

The project is designed for 150 customers and will be conducted in both multi-floor apartments and single-family houses. For the project implementation, PA Consulting Group (formerly Hagler Bailly) is procuring residential gas heaters and other gas ancillary equipment and will also reimburse the standard allowance for customers' piping that is being charged for the establishment of new service.

“YEREVANGAS” GGB will assume responsibility for providing all network rehabilitation work up to the customers' meter installation. Monthly bills for gas consumption will be presented to each participating customer, and customers will be responsible for monthly payments according to their bills.

In order to evaluate the effects of the pilot project, PA Consulting Group (formerly Hagler Bailly) will conduct a customer survey to determine energy consumption of households involved in the project, comfort and payment levels. This information will be compared with data gathered after the gas service rehabilitation and heater installations.

If you have any further questions regarding this pilot project, please feel free to contact YEREVANGAS GGB.

Attachment B – Fuel Substitution Project Customer Survey

**Survey for Natural Gas Pilot Project**

Date Survey Taken: \_\_\_\_\_

Name: \_\_\_\_\_ Electric Account No. \_\_\_\_\_

Address: \_\_\_\_\_ Gas Account No. \_\_\_\_\_

---

**Information**

1. Type of residence                      Apt. \_\_\_\_\_                      Individual House \_\_\_\_\_

2. How many people are living in the residence \_\_\_\_\_

3. How many rooms are in the residence \_\_\_\_\_

4. Approximate residence size in (m<sup>2</sup>) \_\_\_\_\_

5. Approximate area heated in residence in (m<sup>2</sup>) \_\_\_\_\_

6. Which of the following fuels do you use for cooking (check all that apply):

Electric \_\_\_\_\_

Propane \_\_\_\_\_

Kerosene \_\_\_\_\_

Wood \_\_\_\_\_

Other \_\_\_\_\_

7. Approximate cost for heating by fuel type in (AMD):

Electric \_\_\_\_\_

Propane \_\_\_\_\_

Kerosene \_\_\_\_\_

Wood \_\_\_\_\_

Other \_\_\_\_\_

8. Have you done any weatherization for this and last season?

\_\_\_\_\_

9. Type of the installed meter (TOU/Simple): \_\_\_\_\_

10. On a scale of 1 to 10, how comfortable would you say you and members of the household are during the heating season (1 is not comfortable, 10 is very comfortable): \_\_\_\_\_

---

11. Cost of electricity by months: (will obtain this information from YDC)

Nov 99 \_\_\_\_\_

Dec 99 \_\_\_\_\_

Jan 00 \_\_\_\_\_

Feb 00 \_\_\_\_\_

Mar 00 \_\_\_\_\_

Apr 00 \_\_\_\_\_

12. Survey taker's opinion on customer's economic condition:

Low \_\_\_\_\_ Middle \_\_\_\_\_ High \_\_\_\_\_

Attachment C – Fuel Substitution Survey Results

**Customer Survey Results**  
**Armenia Natural Gas Usage Pilot Project**

<b>Survey Question</b>	<b>Apartments</b>	<b>Single Family Homes</b>	<b>Total</b>
Avg. No. of People in Residence	3.6	4.8	3.8
Avg. No. of Rooms in Residence	2.0	3.3	2.3
Avg. Approx. Residence Size (m²)	77.8	66.1	75.4
Avg. Approx. Area Heated (m²)	47.8	47.9	47.8
Fuels Used for Cooking:			
Electricity	32.4%	21.4%	30.1%
Propane	69.4%	78.6%	71.3%
Kerosene	0.9%	0%	0.7%
Wood	0%	3.6%	0.7%
Fuels Used for Heating:			
Electricity	67.6%	14.3%	56.6%
Propane	0%	0%	0%
Kerosene	6.5%	3.6%	5.9%
Wood	16.7%	85.7%	30.9%
Avg. Approx. Cost for Heating by Fuel Type (in AMD/month):			
Electricity	14, 986	18, 750	15, 182
Propane	0	0	0
Kerosene	6, 000	700	5, 338
Wood	7, 306	9, 625	8, 631
% of Residences Completed Weatherization	43%	39%	42%
Type of Installed meter:			
Inductive	48%	100%	59%
Electronic	52%	0%	41%
Average Comfort Rating:			
Low (1-3)	27.8%	17.9%	25.7%
Middle (4-6)	50%	64.3%	52.9%
High (7-10)	16.7%	17.9%	16.9%
Avg. Cost of Electricity by Months (AMD):			
Nov 1999	6,814	5,896	6,625
Dec 1999	8,827	6,650	8,379
Jan 2000	9,257	7,496	8,894
February 2000	8,967	6,767	8,134
March 2000	8,348	6,344	6,778
Average Opinion of resident economic condition:			
Low	25%	21.4%	24.3%
Middle	52.8%	60.7%	54.4%
High	18.5%	17.9%	18.4%